

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Gender parity in scientific authorship in a National Institute for Health Research Biomedical Research Centre: A bibliometric analysis
<b>AUTHORS</b>	Shah, Syed Ghulam Sarwar; Dam, Rinita; Milano, Maria; Edmunds, Laurel; Henderson, Lorna; Hartley, Catherine; Coxall, Owen; Ovseiko, Pavel; Buchan, Alastair; Kiparoglou, Vasiliki

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Sabine Oertelt-Prigione Radboud University, Netherlands
<b>REVIEW RETURNED</b>	28-Apr-2020

<b>GENERAL COMMENTS</b>	<p>Thank you for giving me the opportunity to review this interesting manuscript on the very relevant topic of gender equity and representation in academia. The authors have analyzed 2409 publications from their broader research environment, a British hospital-academic cooperation set up in Oxford. Authorship was categorized according to a binary gender construct and positions within publications assessed. As previously described in the literature, women are increasingly represented as first authors, although not to the same degree as their male colleagues, and much less as corresponding and senior authors.</p> <p>This information is very important, however, I think it would really benefit from contextualization. The most straightforward way to look at publication statistics is simply monitor female and male achievements over time, however, the contextualization of these achievements within the system of science is an essential point to add.</p> <p>I would urge the authors to give us some context about how many female and male researchers within their department “could” possibly have been represented as authors. It is, of course, not possible to predict contribution, but giving some context as to how many female PhD students and postdocs there are and how many senior female staff compared to the publications might offer an additional layer. If, as in many biomedical research institutions these days, women are 60% or more of the PhD students, their representation as only 40% of the first authors is even more striking. If women are only 20% of the senior staff than their under-representation as senior authors might be less surprising. Given that the authors have access to their internal data, it should be feasible to paint a picture of the overall gender representation of staff.</p> <p>Second, one aspect that is frequently mentioned in this context, is the fact that women publish less, but might obtain more citations on the publications they author, potentially closing this gap. This aspect might be important from a policy perspective. If women are more</p>
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	<p>reluctant to publish, because e.g. they have a more conservative approach and prefer to accumulate more data before making a claim, but their eventual publication gets cited more, this needs to be considered for future academic evaluations. How do the analyzed publications, with female/male junior and senior authors, distribute according to journal prestige and citations? Are there trends to be seen? The literature points to women making more conservative claims about their findings and potentially publishing in less prestigious journals, but obtaining many citations on their work, is this reflected in this institutions' data?</p> <p>Last, the institution analyzed obtained large public funding, but I assume that in addition to this grant, external funds will have been acquired. Manuscripts should list these funding sources and there have been previous reports in the literature about potential differences in funding sources (possibly also amounts, but it is difficult to obtain this information) between female and male investigators. Publishing does depend to a certain degree on funding for staff, so additional support beyond the core funding could explain some publication differences. It could also highlight another source of bias and gender inequity in structural research support. Would it be possible to obtain any information on this?</p> <p>Overall, I think this is a very valuable contribution and the authors should make the best possible use of the privileged access to their internal data. Most publications in this field lack the important contextual factors needed to shine more light on the inequities that can be addressed to improve gender equity in science. These authors could and should make use of this opportunity.</p>
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<b>REVIEWER</b>	Randall Loder Indiana University School of Medicine, USA
<b>REVIEW RETURNED</b>	18-May-2020

<b>GENERAL COMMENTS</b>	<p>Line 110. The word "inform" seems awkward. Perhaps "study" or "analyze" might be better.</p> <p>Lines 114-117. This paragraph is confusing and seems out of place. Would suggest deletion, unless the authors can better clarify what they are trying to convey and place it in a better spot in the manuscript.</p> <p>Line 145: Can the authors explain why the included comments, editorials, opinions, meeting reports in the mix? These aren't really formal research studies (at least in this reviewer's mind).</p> <p>Lines 210-219: Could the authors actually include the data in a table? I would personally like to see it as a reader.</p> <p>Lines 220-225: Was there any significant change over time? A Cochran linear trend test might be helpful here.</p> <p>Lines 226-234: Same as for lines 210-219.</p> <p>Figure 2: I find this very difficult to see. The black background and small lines are difficult to interpret. Could the authors submit a better figure?</p> <p>Do the actual chi square values need to be reported? I think just the p value is adequate, as having the value seems cumbersome to this reader (unless the journal actually requires the chi square value).</p>
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## VERSION 1 – AUTHOR RESPONSE

First reviewer's comments:

1. This information is very important, however, I think it would really benefit from contextualization. The most straightforward way to look at publication statistics is simply monitor female and male achievements over time, however, the contextualization of these achievements within the system of science is an essential point to add. I would urge the authors to give us some context about how many female and male researchers within their department "could" possibly have been represented as authors. It is, of course, not possible to predict contribution, but giving some context as to how many female PhD students and postdocs there are and how many senior female staff compared to the publications might offer an additional layer. If, as in many biomedical research institutions these days, women are 60% or more of the PhD students, their representation as only 40% of the first authors is even more striking. If women are only 20% of the senior staff than their under-representation as senior authors might be less surprising. Given that the authors have access to their internal data, it should be feasible to paint a picture of the overall gender representation of staff.

- Authors' Response: The following paragraph has been added to the 'Setting' section on page 5 of the main document (see lines 149-154): "Staff who have all or part of their salary funded through the BRC award are members of the NIHR faculty. Between April 2012 and March 2017, there were 73.64% principal investigators (scientists that have won research grants and are ultimately responsible for the conduct of research studies); 59.76% NIHR investigators (scientists leading and undertaking research); 31.85% NIHR associates (staff supporting research that are led by others) and 52.97% NIHR trainees (those who are engaged in research training leading to a higher degree by research) that were male."

2. Second, one aspect that is frequently mentioned in this context, is the fact that women publish less, but might obtain more citations on the publications they author, potentially closing this gap. This aspect might be important from a policy perspective. If women are more reluctant to publish, because e.g. they have a more conservative approach and prefer to accumulate more data before making a claim, but their eventual publication gets cited more, this needs to be considered for future academic evaluations. How do the analyzed publications, with female/male junior and senior authors, distribute according to journal prestige and citations? Are there trends to be seen? The literature points to women making more conservative claims about their findings and potentially publishing in less prestigious journals, but obtaining many citations on their work, is this reflected in this institution's data?

- Authors' Response:

In response to the above suggestion, we have undertaken a new analysis i.e. journal impact factor and publications by authorship types. Hence, we have added an additional objective also. We have explored doing a new citations analysis as well, but unfortunately could not do it this time because our original database did not contain data on citation counts and collecting reliable citations data in a short period did not prove to be feasible. Given the scope of the required data collection and analysis, we have decided to do this analysis in the future.

For investigating male and female authors at first, corresponding and last authorships positions in prestigious journals (high impact factor journals), we have extracted journal impact factors from the Journal Citation Reports for 2019 or the latest available year. We have analysed the journal impact factor by the gender of authors in three authorship categories i.e. first author, corresponding author and last author. We did not find any statistically significant difference in the impact factor of journals and publications by male and female authors in all three categories (Tables 4-5, Figure 3).

3. Last, the institution analyzed obtained large public funding, but I assume that in addition to this

grant, external funds will have been acquired. Manuscripts should list these funding sources and there have been previous reports in the literature about potential differences in funding sources (possibly also amounts, but it is difficult to obtain this information) between female and male investigators. Publishing does depend to a certain degree on funding for staff, so additional support beyond the core funding could explain some publication differences. It could also highlight another source of bias and gender inequity in structural research support. Would it be possible to obtain any information on this?

- Authors' Response: The following paragraph has been added to the 'Setting' section on from pages 5-6 of the main document (see lines 159-163): "during the same study period, the NIHR Oxford BRC was awarded with external funding from research councils, research charities, the Department of Health, industry collaborators and non-commercial organisations. Research councils have provided the highest amount of external funding with an amount of £265.5m. However, current data from the NIHR Oxford BRC are not available at an individual level, hence, it is not possible to present this data according to gender."

4. Overall, I think this is a very valuable contribution and the authors should make the best possible use of the privileged access to their internal data. Most publications in this field lack the important contextual factors needed to shine more light on the inequities that can be addressed to improve gender equity in science. These authors could and should make use of this opportunity.

- Authors' Response: We are grateful for the reviewer's appreciation of our work.

Second reviewer's comments:

5. Line 110. The word "inform" seems awkward. Perhaps "study" or "analyze" might be better.

- Authors' Response: Noted. Please see page 5 of the manuscript. The word 'inform' has been changed to 'study'.

6. Lines 114-117. This paragraph is confusing and seems out of place. Would suggest deletion, unless the authors can better clarify what they are trying to convey and place it in a better spot in the manuscript.

- Authors' Response: The following paragraph has been removed from the revised manuscript. "For addressing the paucity of empirical research on women's advancement and leadership in translational research in the UK and Europe, a recent study on gender equity in Neurology suggests the need for institutions to take a systematic approach to addressing gender disparities that involve customised, defined metrics and transparent reporting to stakeholders[30]." Please see page 5 of the manuscript.

7. Line 145: Can the authors explain why the included comments, editorials, opinions, meeting reports in the mix? These aren't really formal research studies (at least in this reviewer's mind).

Authors' Response: Even though some of the studies are not strictly scientific publications, they still reflect gender disparities in the BRC, as all the authors are still academics. We also assumed that the authorship order for this type of publication is still negotiated between group members. They were identified as a separate group ('other studies') so that it would be possible to consider different types of publications. From the operational point of view, we wanted to test data that was already being routinely collected in the organisation as this would make future tracking achievable and easier to combine with the day-to-day activities in the BRC.

For clarification purposes, any reference to 'research studies' in the 'Results' section from pages 7-8, have been amended to 'publication'.

8. Lines 210-219: Could the authors actually include the data in a table? I would personally like to see it as a reader.

- Authors' Response: Noted. Only the statistically significant associations are shown in Table 3 with a title: 'Gender of authors by publication type', on page 9 of the main document. For clarification purposes, the following sentence has been added to the main document on page 9 above Table 3: "Only the statistically significant associations are shown in Table 3".

9. Lines 220-225: Was there any significant change over time? A Cochran linear trend test might be helpful here.

- Authors' Response: We thank the reviewer for the suggestion. We have added the following sentence in the main document. Please see page 9 of the main document. "We also ran a Cochran linear trend test to show whether there was any significant change over time. The results revealed that the test was not significant for all six authorship types and years of publications (for all six categories)."

10. Lines 226-234: Same as for lines 210-219.

- Authors' Response: Noted. Only the statistically significant associations are shown in Tables 4(a) and 4(b) entitled: 'Association between same gender across authorship categories', on pages 9-10 of the main document. For clarification purposes, the following sentence has been added to the main document on page 10 above Tables 4(a) and 4(b): "Only the statistically significant associations are shown in Tables 4(a) and 4(b)."

11. Figure 2: I find this very difficult to see. The black background and small lines are difficult to interpret. Could the authors submit a better figure?

- Authors' Response: Figure 2 is now clear and legible and has been submitted with the revised version of the manuscript.

12. Do the actual chi square values need to be reported? I think just the p value is adequate, as having the value seems cumbersome to this reader (unless the journal actually requires the chi square value).

- Authors' Response: All chi-square values have been deleted and only p-values are reported throughout the manuscript and in tables.

### VERSION 2 – REVIEW

<b>REVIEWER</b>	Sabine Oertelt-Prigione Radboud University, Netherlands
<b>REVIEW RETURNED</b>	22-Sep-2020

<b>GENERAL COMMENTS</b>	<p>Thank you for giving me the opportunity to review this improved version of the manuscript. I commend the authors for the additional work performed. In my opinion the paper is significantly improved, however, a few minor points still need be considered.</p> <p>When I asked for gender distribution within the institution my goal was to offer some perspective to the results. Unfortunately, this transfer has not been added, yet. The current numbers show 74% male PIs (i.e. the potential corresponding and last authors) and about 60% male NIHR investigators (i.e. the potential first authors). In how far does this relate to the reported authorship trends? You report a 77/23% split in last authorships and a 59/41% distribution of the first authorships. This appears quite in line with what is potentially achievable or am I missing something here? Of course, this is not statistically ascertained by your data, but it might be worthwhile to mention in the discussion. With this data, the problem does not seem to be an inequity in publication trends, but more of an inequity in representation. Basically, readers would assume that once the numbers of researchers are equal, the publication trends should also be. As a side note, you might compliment your institution on doing quite well in allowing researchers of both genders to reach their potential.</p>
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	<p>The requested information on external funding is now reported in lines 155-160. Since the data is not disaggregated by gender its contribution is limited and I wonder if adds to the research question.</p> <p>I am also not sure about the added value of table 6. It appears a bit random. When I look at it and think about the 26% women PIs, I actually wonder if they are outperforming their male colleagues when it comes to representation in high impact journals. I don't know if this could be quantified, but I don't see an additional value in this table otherwise. I would leave it up to the editors to decide on its need.</p> <p>The sentence in line 329-331 is basically a repetition of the one in 328-329. I think one conclusion might suffice.</p> <p>Figure 3 is very difficult to read, I would suggest changing the light blue into dark blue and maybe darkening the orange dots a bit as well. Also, if this figure stays, maybe the table 6 mentioned before might not be needed.</p>
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## VERSION 2 – AUTHOR RESPONSE

Authors' response to Reviewer: 1 Comments to the Author

Reviewer's comments: Thank you for giving me the opportunity to review this improved version of the manuscript. I commend the authors for the additional work performed. In my opinion the paper is significantly improved, however, a few minor points still need be considered.

Authors' reply: We greatly appreciate the reviewer's detailed comments and careful consideration. Many thanks.

Reviewer's comments: When I asked for gender distribution within the institution my goal was to offer some perspective to the results. Unfortunately, this transfer has not been added, yet. The current numbers show 74% male PIs (i.e. the potential corresponding and last authors) and about 60% male NIHR investigators (i.e. the potential first authors). In how far does this relate to the reported authorship trends? You report a 77/23% split in last authorships and a 59/41% distribution of the first authorships. This appears quite in line with what is potentially achievable or am I missing something here? Of course, this is not statistically ascertained by your data, but it might be worthwhile to mention in the discussion. With this data, the problem does not seem to be an inequity in publication trends, but more of an inequity in representation. Basically, readers would assume that once the numbers of researchers are equal, the publication trends should also be. As a side note, you might compliment your institution on doing quite well in allowing researchers of both genders to reach their potential.

Authors' reply: Thanks to the reviewer for raising this point again. In the context of the UK, Principal Investigations are typically ranked as last authors. This is based on our own experience and published studies for example see Patel et al 2019 (DOI 10.1177/0141076819851666). Based on this information and the proportions of principal investigators (74% male and 26% female) in the NIHR Oxford BRC, the observed proportions of the male last authors (77%) and female last authors (23%) are comparable to the actual proportions of male and female PIs. Based on these findings, we argue that the NHIR Oxford BRC is doing very well in gender equity between male and female last authors. We have added this information in the discussion (lines 317-325, Page 13). We do not have sufficient information about the remaining categories of authorship; therefore could not add further perspective. Accordingly, we have revised our conclusions in the abstract (page 2), highlights (page 3) and conclusion section (page 15).

Reviewer's comments: The requested information on external funding is now reported in lines 155-160. Since the data is not disaggregated by gender its contribution is limited and I wonder if adds to the research question.

Authors' reply: We have deleted this information as it is not disaggregated by gender (lines 171-176, page 6).

Reviewer's comments: I am also not sure about the added value of table 6. It appears a bit random. When I look at it and think about the 26% women PIs, I actually wonder if they are outperforming their male colleagues when it comes to representation in high impact journals. I don't know if this could be quantified, but I don't see an additional value in this table otherwise. I would leave it up to the editors to decide on its need.

Authors' reply: As suggested by the reviewer, we have removed Table 6 (page 12) and information about it (lines 202-303, page 12). The journal impact factor analysis is shown in Figure 3 (please see revised figure on page 12) and statistical analysis of impact factors by authorship types is reported in text (lines 295-298, page 11) and Table 5 (page 11). We did not find any significant evidence of the differences in the mean journal impact factor in publications by male and female authors (Table 5, page 11).

Reviewer's comments: The sentence in line 329-331 is basically a repetition of the one in 328-329. I think one conclusion might suffice.

Authors' reply: We have deleted the suggested sentence (lines 366-367, page 14) and made some additional changes (lines 360-369, page 14).

Reviewer's comments: Figure 3 is very difficult to read, I would suggest changing the light blue into dark blue and maybe darkening the orange dots a bit as well. Also, if this figure stays, maybe the table 6 mentioned before might not be needed.

Authors' reply: We have revised Figure 3. Please see page 12.

### VERSION 3 – REVIEW

<b>REVIEWER</b>	Sabine Oertelt-Prigione Radboudumc, Netherlands
<b>REVIEW RETURNED</b>	06-Jan-2021
<b>GENERAL COMMENTS</b>	The authors have fully addressed all of the raised comments and I believe the manuscript warrants publication. There is a typo in line 551, which should be removed.